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PSAMMOLITTORAL ROTIFERS OF LENAPE AND UNION LAKES, NEW JERSEY

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The present work is the result of a study pursued during the spring, summer and fall of 1934, on the rotatorian fauna that inhabits the moist sand zones, adjacent to and above the level, of various bodies of water situated in the pine-barren area of southern New Jersey, especially Lenape and Union Lakes, in Atlantic and Cumberland Counties, respectively.

The soil of this area consists of gravel and sand beds which were at one time the bottom of the ocean. As a result of ages of weathering, most of the calcium and potassium salts as well as the calcium carbonate have been leached out. Acids arising from vegetable decomposition and other sources remain unneutralized, therefore the waters are acid.

There are no natural lakes in this portion of the state. The so-called "lakes" are merely dammed areas which, at present or formerly, served for power purposes.

On account of their relatively larger size, the majority of collections were made along the shores of the above two "lakes." Lenape Lake is formed by a dam and is about two miles in length and about one-third of a mile in width at the widest part. It is thirteen feet above sea level, and the p_H varies between 5.0 and 6.4. Union Lake is about three miles long and about one-half of a mile wide at the widest part. It is twenty-six feet above sea level, and the p_H varies between 6.0 and 6.8.

The water of both lakes is colored a dark reddish brown, due to infusions of decaying plant material, as a result of draining large areas of sphagnum bogs. The inlets and adjacent banks are marshy, due to plant encroachment, and contain no exposed sand zones. Nearer the middle and the outlets there are many low zones of exposed sand. It was in such locations that most of the collections were made.

Samples of moist sand were taken at different distances from the water level, in the regions of the "hydropsammon,"[1] the "hygrops-

[1] Wiszniewski has proposed a nomenclature based on the ecology of the psammolittoral. Among the important terms are: "hydropsammon," submerged sand along the shore of a body of water; "hygropsammon," sand above and adjacent to the water level that is completely saturated by capillary attraction and wave action; "eupsammon," outer boundary of the hygropsammon, partially saturated, and submerged only during periods of high water.

ammon" and the "eupsammon." To these were added a certain quantity of filtered water from the main source. Later, the various containers were shaken as needed, the superincumbent water quickly decanted and then examined under a binocular microscope.

Most of the samples were from the hygropsammon, which is composed of two phases: "the sand grains, having no value as far as conditions of existence to rotifer life are concerned, and the water contained between them." It is there the optimum conditions of food, oxygen and light prevail: it is there the sand is fully saturated with water, due to wave action and also by being drawn up by capillary attraction to replace that lost by evaporation, thus making conditions of existence ideal for psammobiotic rotifers.

Wiszniewski recently studied the rotifers living in the psammolittoral along the banks of Lake Wigry, Poland, and other bodies of water in that country. The p_H was uniformally 7.5. The results were so rich that the author was able to compile a list of 82 species occurring in the moist sand.[1] No such habitat had previously been searched with careful scrutiny for rotifers.

In order to compare the psammolittoral rotifers, found in the alkaline waters of Poland, with those from the acid bodies of water in southern New Jersey, samples were taken from various zones at numerous locations. The results were found to be very rich, as the following list will show.

FAUNAL LIST

The symbols after specific names have the following significance: a, psammobiotic[2]; b, psammophile; c, psammoxene; 1, superabundant, occurring in large numbers; 2, common, evenly scattered; 3, few, here and there; 4, rare, isolated specimens; 5, very rare, fortuitous; * found also in Poland.

Ascomorpha agilis Zacharias, c, 4
Ascomorpha agilis var. *americana* Beauchamp, c, 5
Ascomorpha ecaudis Perty, c, 4
Ascomorpha saltans Bartsch, c, 4,*
Aspelta aper (Harring), c, 3 to 4
Aspelta beltista Harring and Myers, c, 4
Aspelta circinator (Gosse), c, 4
Aspelta egregia, new species, a, 3 to 4

[1] Wiszniewski, 1934, Arch. Hydrobiol. Ichthyol., VIII, p. 228.

[2] The terms proposed by Wiszniewski for groups of rotifers inhabiting the psammolittoral are: "psammobiotic," sand living rotifers, found nowhere else except fortuitously; "psammophile," sand loving rotifers, found also in the littoral regions among aquatic vegetation; "psammoxene," sand alien rotifers, mostly limnetic and plankton species, found only in the above two zones fortuitously.

Aspelta imbuta Harring and Myers, c, 5
Brycella tenella (Bryce), b, 2, *
Cephalodella apocolea Myers, b, 2 to 3, *
Cephalodella auriclata (Müller), b, 2 to 1, *
Cephalodella compacta Wiszniewski, a, 2, *
Cephalodella elongata Myers, b, 3
Cephalodella eva (Gosse), c, 4, *
Cephalodella exigua (Gosse), b, 2, *
Cephalodella forficula (Ehrenberg), c, 5, *
Cephalodella galbina Myers, c, 5
Cephalodella gibba (Ehrenberg), b, 2 to 1, *
Cephalodella gracilis (Ehrenberg), c, 3, *
Cephalodella innesi Myers, c, 5
Cephalodella inquilina Myers, c, 3 to 4
Cephalodella intuta Myers, c, 3
Cephalodella megalocephalia (Glascott), c, 4, *
Cephalodella mucronata Myers, c, 4
Cephalodella physalis Myers, c, 4
Cephalodella remanei Wiszniewski, b, 4, *
Cephalodella tantilla Myers, b, 3 to 4
Cephalodella tenuior (Gosse), c, 4, *
Colurella obtusa (Gosse), b, 2 to 3, *
Colurella tesselata (Glascott), c, 4
Cyrtonia tuba (Ehrenberg), c, 5
Dicronella gracilis, new genus, new species, a, 4
Dicranophorus artamus Harring and Myers, b, 2 to 3
Dicranophorus capucinus Harring and Myers, b, 2 to 3
Dicranophorus edestes Harring and Myers, c, 4, *
Dicranophorus haueri Harring and Myers, c, 5
Dicranophorus hercules Wiszniewski, a, 2 to 3, *
Dicranophorus hercules var. *capucinoides Wiszniewski*, a, 2 to 3, *
Dicranophorus lütkeni (Bergendal), b, 2, *
Dicranophorus proclastes Harring and Myers, c, 5
Dicranophorus robustus Harring and Myers, c, 4, *
Dicranophorus rostratus (Dixon-Nuttall and Freeman), b, 3 to 4
Dicranophorus thysanus Harring and Myers, c, 5
Dissotrocha macrostyla (Ehrenberg), c, 4
Diurella bidens Lucks, c, 4
Diurella brachyura (Gosse), c, 4
Diurella cavia (Gosse), c, 3 to 4
Diurella collaris (Rousselet), c, 4
Diurella edmondsoni, new species, c, 4
Diurella insolens, new species, a, 2 to 1
Diurella intermedia (Stenroos), c, 4, *
Diurella porcellus (Gosse), c, 3 to 4, *
Diurella stylata Eyferth, c, 4
Diurella tenuior (Gosse), c, 4, *
Diurella tigris (Müller), b, 3 to 4

Diurella uncinata Voight, b, 3 to 4, *
Diurella tortuosa, new species, b, 3 to 4
Elosa worralli Lord, b, 2 to 3
Encentrum felis (Ehrenberg), c, 4
Encentrum insolitum, new species, a, 2
Encentrum lacidum Harring and Myers, c, 5 (brackish water, Mullica River)
Erignatha clastopis (Gosse), c, 5
Euchlanis alata Voronkov, c, 5
Euchlanis arenosa new species, a, 2 to 1
Euchlanis callysta Myers, c, 5
Euchlanis meneta Myers, c, 3 to 4
Euchlanis parva Rousselet, c, 3 to 4
Euchlanis pellucida Harring, c, 5
Gastropus hytopus (Ehrenberg), c, 5
Gastropus minor (Rousselet), b, 3 to 4
Gastropus stylifer Imhof, c, 4, *
Keratella cochlearis (Gosse), c, 3 to 4, *
Keratella serrulata (Ehrenberg), c, 4
Lecane agilis (Bryce), c, 4
Lecane aquila Harring and Myers, c, 5
Lecane clara (Bryce), b, 2 to 3, *
Lecane flexilis (Gosse), b, 2 to 3, *
Lecane inquieta, new species, a, 1 to 2
Lecane ligona (Dunlop), c, 5
Lecane mira (Murray), c, 4
Lecane mucronata Harring and Myers, a, 1 to 2
Lecane pertica Harring and Myers, c, 5
Lecane pyrrha Harring and Myers, c, 5
Lecane stichaea Harring, c, 3
Lecane tenua, new species, a, 3
Lepadella benjamini Harring, c, 5
Lepadella ovalis (Müller), b, 3, *
Lepadella patella (Müller), b, 3, *
Lepadella venefica Myers, c, 4
Lindia annecta Harring and Myers, c, 2 to 3
Microcodon clavus Ehrenberg, c, 5
Mikrocodides chlaena (Gosse), c, 5
Monommata astia Myers, b, 3 to 4, *
Monommata diaphora Myers, c, 5
Monommata grandis Tessin, c, 5
Monommata longiseta (Müller), c, 5
Monostyla bulla var. *styrax* (Harring and Myers), c, 4
Monostyla closterocerca Schmarda, c, 3 to 4, *
Monostyla hamata Stokes, c, 4, *
Monostyla lunaris (Ehrenberg), b, 2 to 3, *
Monostyla mitella, new species, a, 2 to 3
Monostyla psammophila Wiszniewski, a, 4, *
Monostyla pygmaea Daday, c, 4

Monostyla quadradentata Ehrenberg, c, 5
Monostyla scutata Harring and Myers, c, 4, *
Myersina tetraglena Wiszniewski, a, 3 to 4, *
Notommata cerebrus (Gosse), c, 4
Notommata contorta Stokes, c, 5
Notommata fasciola Myers, c, 5
Notommata diasema, new species, a, 3 to 4
Notommata galena Harring and Myers, c, 5
Notommata pachyura (Gosse), c, 5
Notommata saccigera Ehrenberg, c, 4
Notommata tripus Ehrenberg, b, 2 to 3
Ploesoma lenticulare (Herrick), c, 5
Ploesoma truncatum (Levander), c, 5
Polyarthra trigla (Ehrenberg), c, 3, *
Proales decipiens (Ehrenberg), c, 3 to 4
Proales doliaris (Rousselet), c, 3 to 4
Proales granulosa Myers, c, 5
Proales sordida Gosse, c, 5
Resticula melandocus (Gosse), c, 5
Rotaria rotatoria (Pallas), b, 3, *
Rotaria sordida (Western), c, 4
Rotaria tardigrada (Ehrenberg), c, 5, *
Rousseletia corniculata Harring, c, 5
Squatinella longispina (Tatem), c, 5
Synchaeta longipes Gosse, c, 5
Synchaeta oblonga Ehrenberg, c, 5, *
Synchaeta pectinata Ehrenberg, c, 5
Synchaeta stylata Wierzejski, c, 5
Synchaeta tremula (Müller), c, 5, *
Taphrocampa annulosa Gosse, b, 2 to 3, *
Testudinella dicella Myers, c, 5
Testudinella epicopta Myers, c, 5
Testudinella incisa (Ternetz), c, 4
Trichocerca bicristata (Gosse), c, 5
Trichocerca longiseta (Schrank), c, 4
Trichocerca multicrinis (Kellicott), c, 5
Trichocerca rattus (Müller), c, 5
Trichotria eukosmeta Myers, a, 2 to 3
Trichotria tetractis (Ehrenberg), c, 3, *
Trichotria tetractis var. *caudata* (Lucks), c, 5
Wierzejskiella velox Wiszniewski, a, 4, * (also from Piseco Lake, New York)

The above list contains 145 species, 44 of which have been recorded from Poland. There are 37 species from Poland that have not been found in New Jersey, making a total of 182 species from the psammolittoral of both countries.

In looking over the combined lists, one is struck by the total absence

of the cosmopolitan genus *Brachionus*. This is not surprising for the pine-barren area of New Jersey, as the genus belongs to the alkaline water fauna and is only found fortuitously in acid water. Their total absence in the alkaline psammolittoral of Poland is significant, especially as the closely related genus *Notholca* is represented by three species.

There are 12 typically alkaline water species on the Poland list, in so far as our knowledge of the limits of this group goes, while there are only 2 on the New Jersey list. There are 2 typically acid water species on the Poland list, while there are 37 from New Jersey. This is not surprising when we consider the respective hydrogen-ion concentration of the two associations.

From the combined faunal lists we find there are 27 psammobiotic species, inhabiting the psammolittoral. They appear rarely in other habitats and then only fortuitously as stragglers. They are:

Aspelta egregia Myers
Cephalodella compacta Wiszniewski
Cephalodella megalotrocha Wiszniewski
Dicranella gracilis Myers
Dicranophorus hercules Wiszniewski
Dicranophorus hercules var. *capucinoides* Wiszniewski
Dicranophorus leptodon Wiszniewski
Diurella insolens Myers
Diurella pygocera Wiszniewski
Diurella taurocephala Hauer
Elosa spinifera Wiszniewski
Encentrum diglandula (Zawadowski)
Encentrum insolitum Myers
Euchlanis arenosa Myers
Lecane inquieta Myers
Lecane levistyla (Olofsson)
Lecane mucronata Harring and Myers
Lecane tenua Myers
Lindia janickii Wiszniewski
Monostyla mitella Myers
Monostyla psammophila Wiszniewski
Myersina tetraglena Wiszniewski
Notommata diasema Myers
Trichotria eukosmeta Myers
Wierzejskiella sabulosa Wiszniewski
Wierzejskiella velox Wiszniewski
Wigrella depressa Wiszniewski

New species described in this paper, as additions to the above fauna, are as follows:

Dicranella gracilis
Aspelta egregia
Encentrum insolitum
Notommata diasema
Diurella insolens
Diurella edmondsoni
Diurella tortuosa
Euchlanis arenosa
Lecane inquieta
Lecane tenua
Monostyla mitella

ORDER **MONOGONONTA**

Family **Dicranophoridae**

DICRANELLA, NEW GENUS

Notommatid rotifers with elongate, cylindric, illoricate body, with a well-marked neck separating the head from the abdomen. Posteriorly the body tapers to a conical foot terminated by two acute, rudimentary toes. There are no indications of a foot joint, but atrophied foot glands are present.

The corona is oval and oblique. The marginal cilia are short with the exception of two lateral auricle-like tufts of longer cilia. There is a small rostrum present which is not enclosed by the marginal ciliation. The buccal field is evenly ciliated.

The mastax is of the forcipate type and asymmetric. The rami are roughly lyrate, terminating in two blunt teeth. The unci have one tooth firmly united to the tips of the rami; the manubria are asymmetric and long. The fulcrum is short and lamellar.

There are two small subcerebral glands, but no retrocerebral sac is present Eyespots are absent.

Dicranella gracilis, new species

Figures 1, 2, 3, 18

The body is elongate, cylindric, slightly convex dorsally and straight ventrally. The integument is very flexible and the rotifer is always hyaline.

The head is separated from the abdomen by a distinct constriction. The corona is oblique, and has moderately long auricle-like tufts of cilia for propulsion. The rostrum is short, broad and rounded anteriorly. The abdomen is elongate and tapers gradually to the small tail. The integument is marked posteriorly by two distinct skin folds. The foot and rudimentary toes are confluent and without joints. The toes are short and very acute; they are incapable of movement and, in this case, merely furcate caudal appendages. There are remnants of foot glands but no ducts.

The mastax is of modified forcipate type. The trophi are rather small and stout. The rami are irregularly lyrate and each terminates in two blunt teeth. Attached to the left ramus is a very large subsquare alula; there is none present on the right ramus. The unci each have a single large tooth, clubbed at the tip. The manubria are long and stout, the left being much longer than the right, and it is strongly incurved posteriorly; no basal plates are present. The fulcrum is a short lamellar plate which gradually diminishes in width and is acutely pointed distally.

The antennae are normal and in the usual positions.

The gastric glands are oval and of medium size. There is no constriction between the stomach and the intestine. The ovary and bladder are normal.

The ganglion is long and saccate; anteriorly there is a very small pair of subcerebral glands. Neither retrocerebral sac nor eyespots are present.

Total length, 200–210μ.

Dicranella gracilis was found sparingly in the hygropsammon of Lenape Lake, during the month of September. The posterior portion of the body strongly resembles some of the species of *Gastrotricha,* due to the presence of caudal appendages instead of toes—the only instance of its kind among the *Rotifera.* As the species has only been found in the hygropsammon, it is probably psammobiotic.

Cat. No. A. M. N. Hist. 766, cotype.

The male bears little resemblance to the female. The toes are bulbous at the base and end in bristle-like tips.

Cat. No. A. M. N. Hist. 787.

Family **Dicranophoridae**

Aspelta egregia, new species

Figures 6, 7

The body is moderately elongate, fusiform, gibbous dorsally and straight ventrally. The integument is very thin and the outline changes constantly with the incessant contortions of the individual.

The head is long and separated from the abdomen by a well-marked neck fold. The corona is ventral, with prominent lateral auricle-like tufts of longer cilia. The rostrum is prominent, broad at the base, rounded anteriorly and slightly decurved. The abdomen is moderately long, gibbous dorsally, deepest beyond mid-length, from whence it tapers gradually to the small tail. The integument is marked posteriorly by two circular skin folds. The foot is small and conical. The toes are moderately long, parallel-sided and end in acute tips.

The mastax is of modified forcipate type. The trophi are small, somewhat elongate and highly asymmetric. The rami are narrow at the base, and the left terminates in a stout hook-shaped anterior tooth; they have prominent alulae which originate in the central portion, then curve outward and protrude somewhat ventrally. The unci are rudimentary. The right uncus has one branch resting on the manubrium and two on the ramus, while the left uncus has one branch resting on the ramus attached to a lamellar plate that slides along the ramus directly below it. The manubria are long, fairly stout and somewhat undulate. The fulcrum is a lamellar plate, wide at the base, from whence it diminishes rapidly near mid-length, ending in a long blunt prolongation.

The oesophagus is short. The gastric glands are small and oval. The stomach and intestine are not distinctly separated. The ovary and bladder are normal. The foot glands are stout and pyriform.

The antennae are normal and in the usual positions.

The ganglion is large and saccate, and has a ductless retrocerebral sac attached to its posterior end. Subcerebral glands and eyespots are absent.

Total length, 315–325μ; toes, 45–50μ.

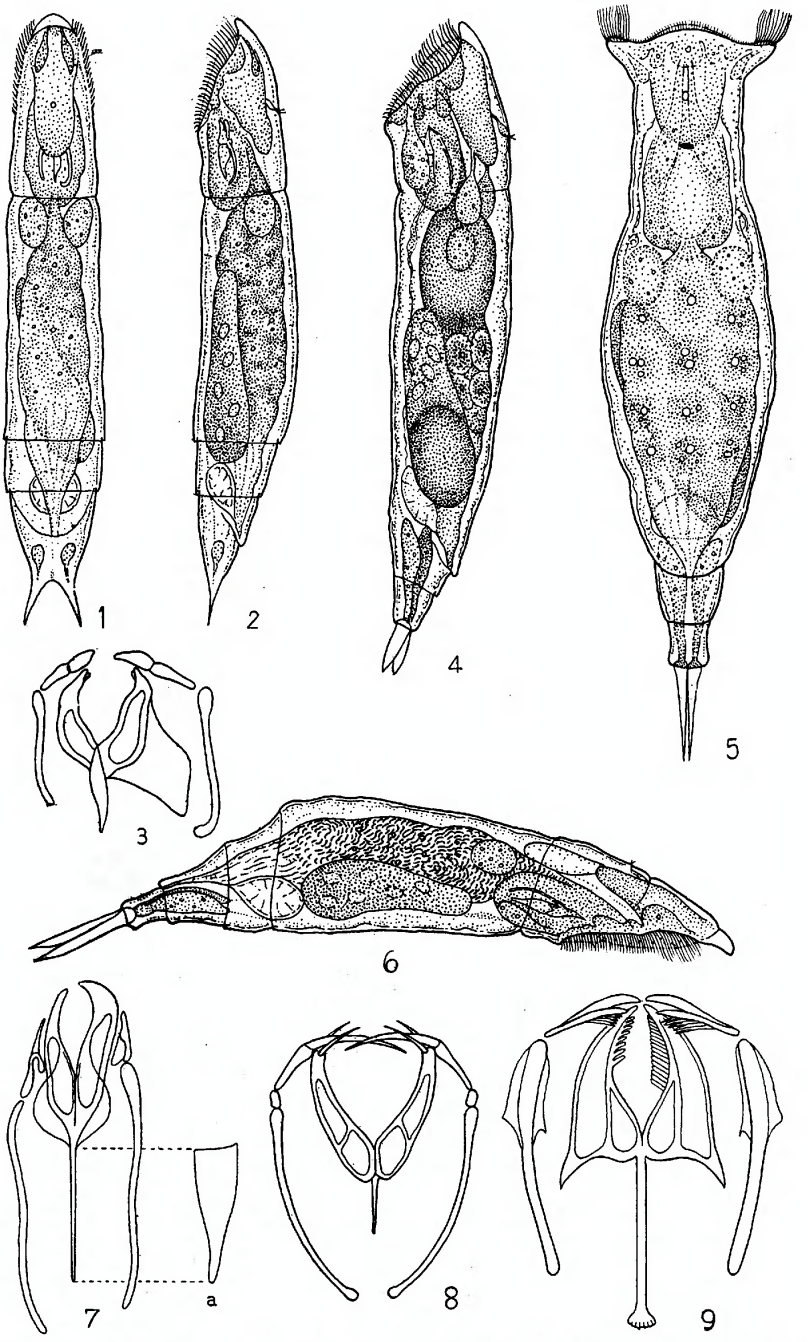

Fig. 1. *Dicranella gracilis*, dorsal view. Fig. 2. *Dicranella gracilis*, lateral view. Fig. 3. *Dicranella gracilis*, trophi, ventral view. Fig. 4. *Encentrum insolitum*, lateral view. Fig. 5. *Notommata diasema*, dorsal view. Fig. 6. *Aspelta egregia*, lateral view. Fig. 7. *Aspelta egregium*, trophi, ventral view; a, fulcrum. Fig. 8. *Encentrum insolitum*, trophi, ventral view. Fig. 9. *Notommata diasema*, trophi, ventral view.

Aspelta egregia was found sparingly in the hygropsammon of Lenape and Union Lakes, during the summer and fall. It was never abundant, but some specimens occurred in many collections. The species bears a certain resemblance to *Aspelta beltista* Harring and Myers, but differs in the shape of the toes, the absence of eyespots and the elements of the trophi. As it has consistently been found in the hygropsammon and nowhere else, it is without doubt a psammobiotic species.

Cat. No. A. M. N. Hist. 780, cotype; trophi, 804.

Family **Dicranophoridae**

Encentrum insolitum, new species

Figures 4, 8

The body is elongate, cylindric and fairly stout. The integument is flexible and the general shape is rather constant.

The head is short and separated from the abdomen by an indefinite constriction. The corona is oblique, and the rostrum is short and rounded anteriorly. The abdomen is elongate, tapering gradually from the neck to the toes. The foot is short and conical. The toes are very short and cylindrical, ending in abrupt tips.

The mastax is of modified forcipate type. On each side of the mouth opening there are a pair of prominent salivary glands. The trophi are relatively small. The rami are lyrate and broad at the base; the tips are blunt and each culminate in two long slender teeth. No alulae are present. The unci are long, slender and somewhat curved; they rest on the rami between the terminal teeth. The intramallei, linking the unci with the manubria, are very small. The manubria are long, slender, incurved and somewhat expanded posteriorly. The fulcrum is short and lamellar.

The gastric glands are small and oval. The posterior portion of the oesophagus is greatly expanded, forming a huge proventirculus. The ovary and bladder are normal. The foot glands are very stout, long and pyriform.

The antennae are normal and in the usual positions.

The ganglion is large and saccate. On both sides, near the posterior end, are two pendant subcerebral glands, each attached by a long tubule to the sac. No eyespots are present.

Total length, 240μ; toes, 15μ.

Encentrum insolitum was collected in the hygropsammon of Lenape Lake in January, 1935. It is evidently a psammobiotic winter species, having been found several times when the absence of ice permitted. Although there are a number of closely related and similar species, this differs from any of them by the presence of the expanded posterior portion of the oesophagus, as well as by the peculiar subcerebral glands, assuming these organs are such, judging by analogous organs in closely related species.

As these rotifers were almost impossible to narcotize, "cooking" was resorted to. The specimens were placed in a watch glass containing a small amount of water. When fully expanded, they were suddenly flooded with boiling water. This has a tendency to swell the individuals, but has the advantage of obtaining them expanded. The rotifers partially regain their normal shape after being infiltrated. Allowances should be made for this in the Museum material.

Cat. No. A. M. N. Hist. 800, holotype; trophi, 804.

Family **Notommatidae**

Notommata diasema, new species

Figures 5, 9, 16

The body is cylindric and rather stout. The integument is very transparent, and the outline varies considerably with the incessant contractions of the individual.

The skin folds limiting the neck are evanescent although this portion is well marked. The trunk increases rather abruptly in breadth, then tapers gradually to the small tail which has one round lobe. The foot is long and has two joints of about equal length. The toes are nearly as long as the foot; from the dorsal view, they are slender and almost straight, slightly enlarged at the base, then tapering gradually, ending in very slender, drawn out tips.

The corona is of the normal *Notommata* type. The auricles are rather small and carry locomotor cilia which are continuous with the circumapical band.

The mastax is of the virgate type. The trophi are robust and symmetric. The ventral portion of the rami are triangular and the opening between them is broadly fusiform. The inner edge of the left ramus is finely denticulate, while the right edge is disposed into eight or ten short, blunt teeth. The unci have five or six preuncial teeth attached to the ventral tooth which, in this case, is shorter than the second tooth, which is followed, in turn, by a slender rudimentary tooth, all being attached to an oval, lamellar basal plate. The manubria are stout and nearly straight, with a broad subsquare lamella at their base. The fulcrum is long and tapers toward the posterior end, which is expanded and incurved.

The stomach is large and the clear intestine is relatively small. The gastric glands, ovary and bladder are normal. The foot glands are very long and stout.

The antennae are normal and in the usual positions.

The ganglion is large and saccate. The retrocerebral sac is long, clear and pyriform, the duct of which could not be traced to the openings on the apical area. The subcerebral glands are elongate and fusiform; their length is little more than one-half that of the sac including the duct. The eyespot is situated at the posterior end of the ganglion.

Total length, 312μ; toes, 42μ.

Notommata diasema was found sparingly in the hygropsammon of Lenape Lake, on several occasions during the summer. As it had been collected previously among aquatic vegetation in the littoral region, it is a psammophile species.

Although there are a number of closely related species, the toes and the trophi are enough to differentiate this from any other member of the genus.

Cat. No. A. M. N. Hist. 777, holotype.

Family **Notommatidae**

Subfamily **Trichocercinae**

Diurella insolens, new species

Figures 11, 13, 15, 19

The body is very stout, evenly arched dorsally and nearly straight ventrally. The posterior portion diminishes rapidly from above the intestine and ends in a prominent cylindrical prolongation. The integument is quite thin and flexible.

The head is very large and separated from the abdomen by a distinct constriction which nearly disappears when the rotifer contracts. Besides having several longitudinal plaits of the head sheath, there are two characteristic mucrones; the left is long and acutely pointed, while the right is shorter and very wide at the base. The corona consists of a marginal circlet of long cilia and several perioral tufts of sensory setae. There are no palplike protuberances on the apical area. The foot is very short and is situated on the ventral side of the body. The foot opening is shaped somewhat like a calabash, with the elongate basal portion directed posteriorly. The toes are directed forward and frequently held retracted within the lorica. The right toe is equal to about one-fourth the length of the body, while the left is somewhat shorter. There is a stout substyle, nearly as long as the left toe, giving an appearance of three toes.

The mastax is modified virgate in type; it is huge and extends posteriorly as far as the middle of the abdomen. The right malleus is bacilliform and much reduced; the left is very stout, and the manubrium has a large terminal hook directed inwards and ventrally. The left uncus is stout and bifid near the tip. The left ramus is prolonged into an acute triangular alula, while the right is slender and much shorter. The left subuncus is composed of three or four slender diverging teeth; the right is composed of five or six, which are much shorter and more slender. There is a long thin rod attached to and supporting the left uncus; its distal end rests in a depression on the base of the left alula. The fulcrum is very long, lamellar, and has a large terminal expansion.

The dorsal antenna is situated above the ganglion to the left of the median line of the body. The lateral antennae are in the normal position.

The gastric glands and bladder are very small and round, the bladder being situated above and behind the foot. On account of the great size of the mastax, the anterior portion of the ovary, which is frequently huge, is often displaced dorsally, embracing the stomach and giving an appearance of the stomach being underneath.

The ganglion is long and saccate, and has a round eyespot attached to its posterior end. There is also a paler frontal eyespot, composed of scattered pigment particles, which is situated on the apical area.

Total length, 170–180μ; left toe, 40–50μ.

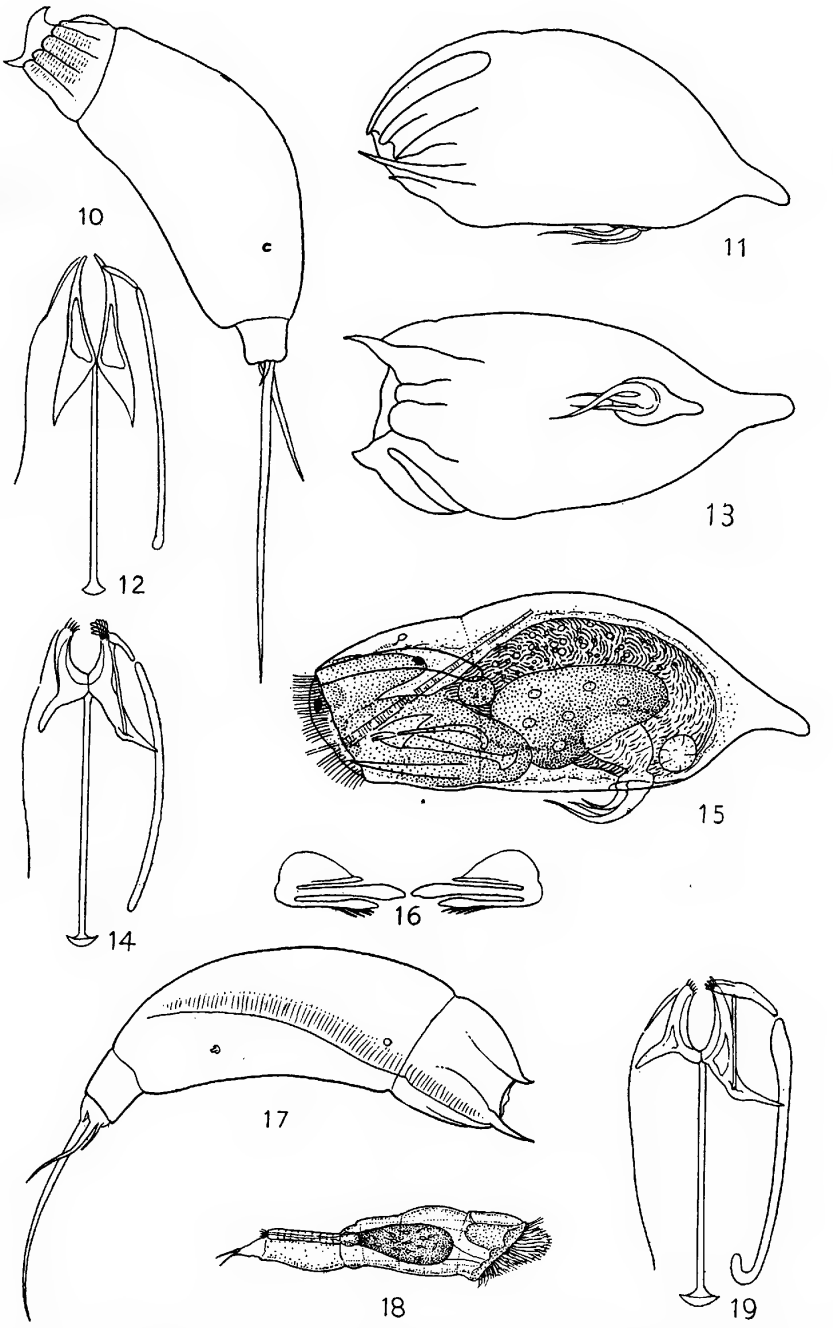

Fig. 10. *Diurella edmondsoni*, lateral view. Fig. 11. *Diurella insolens*, lorica, lateral view. Fig. 12. *Diurella edmondsoni*, trophi, ventral view. Fig. 13. *Diurella insolens*, lorica, ventral view. Fig. 14. *Diurella tortuosa*, trophi, ventral view. Fig. 15. *Diurella insolens*, expanded specimen, lateral view. Fig. 16. *Notommata diasema*, unci, frontal view. Fig. 17. *Diurella tortuosa*, dorsal view. Fig. 18. *Dicranella gracilis*, male, lateral view. Fig. 19. *Diurella insolens*, trophi, ventral view.

Diurella insolens was superabundant in the hygropsammon of both Lenape and Union Lakes, during the summer months. The number of individuals grew less during September and October, disappearing entirely in November. It has certain affinities with the genus *Elosa*, which are as follows:

Diurella insolens	*Elosa*
1. Lorica thin, somewhat flexible	1. Lorica thin, somewhat flexible
2. Frontal mucrones present	2. Frontal mucrones absent
3. Trophi highly asymmetric	3. Trophi highly asymmetric
4. Two eyespots	4. Two eyespots
5. Digitiform posterior prolongation of lorica present	5. Posterior toothlike projection of lorica present or absent
6. No coronal palps	6. No coronal palps
7. Foot opening conspicuous; foot and toes frequently carried within the lorica	7. Foot opening present; foot and toes absent

From the above we see that *Diurella insolens* may well be considered an intermediate species, showing the close relationship between the genera *Diurella* and *Elosa*. This analogy is not uncommon among the rotifers, as is seen in the genera *Asplanchna* and *Asplanchnopus*, where the salient difference consists of the presence or absence of a foot and toes, these two genera being linked together by *Asplanchna harricki* de Guerne, which species has remnants of foot glands, the foot and toes being absent.

Diurella insolens is so distinctive in appearance that it is easily recognized whenever seen. As it has only been found in the hygropsammon, it is undoubtedly a psammobiotic species.

Cat. No. A. M. N. Hist. 762, cotype; trophi, 789.

Diurella edmondsoni, new species[1]

Figures 10, 12

The body is elongate, twisted, cylindric and rather stout. The head is small and is characterized by the presence of a prominent, projecting plate on the right side, bounded dorsally and ventrally by acute diverging mucrones. The head sheath is distinctly set off from the abdomen and is marked by five longitudinal plaits at which the sheath folds when the head is withdrawn. There is no body ridge nor striated area, although the individual plaits of the head sheath are plainly striated. The foot is rather small and sharply set off from the body. The left toe is long and straight; the right is about two-fifths the length of the left and is straight and relatively very stout.

The mastax is modified virgate in type, and the trophi are simple. The right malleus is very slender and bacilliform, the left being much stouter. The left uncus

[1] Dedicated to Mr. Thomas Edmondson, New Haven, Connecticut.

is composed of a single tooth. The left manubrium is long, stout, slightly curved and somewhat expanded posteriorly. The rami are triangular, and symmetric, which is quite unusual in this genus. The alulae are large and approximately equal in size. There is no subuncus present. The fulcrum is long, lamellar and expanded posteriorly.

The antennae are normal and in the usual positions. The internal organs are normal.

Length of body including foot, 150μ; left toe, 120μ; right toe, 45μ.

Diurella edmondsoni was collected sparingly in the hygropsammon of Lenape Lake, during the months of September and October. It has also been found among aquatic vegetation in the littoral region of several bodies of water in the Pine-barrens. It is fortuitous in the hygropsammon and is a psammoxene species. The projecting plate on the right side of the head, the symmetric rami and the very stout right toe are characteristic. The only other instance of a lateral projecting head plate is in *Diurella weberi* Jennings. In that species the plate is evenly rounded and is situated on the left side instead of the right.

Cat. No. A. M. N. Hist. 468, holotype.

Diurella tortuosa, new species

Figures 14, 17

The body is elongate, twisted, cylindric and rather stout; it is widest anteriorly, from whence it tapers gradually to the foot. The head is large and the sheath is marked by two prominent mucrones situated on the dorsal side. The left mucro is long and acute, the right short and divergent. Ventrally, the head sheath is composed of five or six rather indistinct plaits. A low dorsal ridge extends posteriorly from the base of the longer tooth and reaches nearly to the foot. Along the left side of the ridge there is a well marked striated area. The foot is fairly stout and sharply set off from the body. The left toe is somewhat curved and equal to about one-half the length of the lorica. The length of the right toe is equal to about one-half that of the left.

The mastax is of modified virgate type, and the trophi are highly asymmetric. The right malleus is atrophied and bacillar; the left being very robust. The left uncus is provided with three fairly stout teeth, and the subuncus is composed of four or five blunt slender teeth. The right subuncus is composed of five or six short needle-like teeth. Attached to the middle portion of the left uncus is a long slender rod, the distal tip of which rests on the left alula. The rami are roughly triangular. The right alula is elongate and prolonged posteriorly; the left is much longer, and the tip is drawn out into an acute triangle. The fulcrum is very long, lamellar and expanded posteriorly.

The antennae are normal and in the usual positions.

Length of body including foot, 180μ; left toe, 84μ; right toe, 43μ.

Diurella tortuosa was found sparingly in the hygropsammon of Lenape and Union Lakes, during the spring and summer. It is a

psammophile species, being common among aquatic vegetation in the littoral region of various bodies of water in numerous locations. It bears a certain resemblance to *Diurella myersi* Hauer. In that species the head is small and the posterior portion of the body by far the stoutest, which condition is exactly reversed in *Diurella tortuosa*. It also somewhat resembles *Diurella insignis* (Herrick). However, in that species the body is very long, slender and more parallel-sided.

Cat. No. A. M. N. Hist. 792, cotype.

Family **Brachionidae**

Euchlanis arenosa, new species

Figures 20, 25, 26

The body is very deep and laterally compressed. From the dorsal view, it is narrow and elongate oval. The cross-section is in the form of a narrow cone, rounded at the apex.

The lorica and corona agree with the other species of the genus. The abdomen is gibbous dorsally; posteriorly it falls away abruptly, and is nearly straight ventrally. The foot is long, very slender and composed of two joints; it is protected dorsally by a shield, as in some other species of the genus. The toes are straight and stout near the base; at mid-length they diminish in depth, swelling again posteriorly, ending in a decurved clawlike tip.

The mastax is modified malleate in type. The trophi are of the *Euchlanis* type, having the usual denticular combs attached to the inner tip of each ramus. The unci are provided with four stout, club-shaped teeth.

The gastric glands are small and oval. The stomach, intestine, ovary and bladder are normal. The foot glands are long and very slender near the base.

The antennae are in the normal positions, the dorsal not being as stout as in some of the species of the genus.

The retrocerebral sac is huge. It extends at least to the middle of the abdomen in living specimens; it has a tendency to contract somewhat in preserved material. The eyespot is situated at the posterior end of the ganglion.

Total length, 185–225μ; toes, 60–70μ. Depth of body, 90μ. Width, 70μ.

Euchlanis arenosa was superabundant in the hygropsammon of both Lenape and Union Lakes, from July until November. Its movements are extremely fast and restless, as opposed to the other species of the genus, with the possible exception of *Euchlanis alata* Voronkov. Some parasitic rotifers, such as *Pleurotrocha trypeata* (Harring and Myers), on being removed from their host, swim rapidly about as if in search of a new one. This is often the case when psammobiotic rotifers are removed from sand, in the capillary state, to clear water.

The greatly compressed body, the huge retrocerebral sac, the protective foot shield, together with the number of teeth in the unci, distinguish this from any other species of the genus. The foot shield is

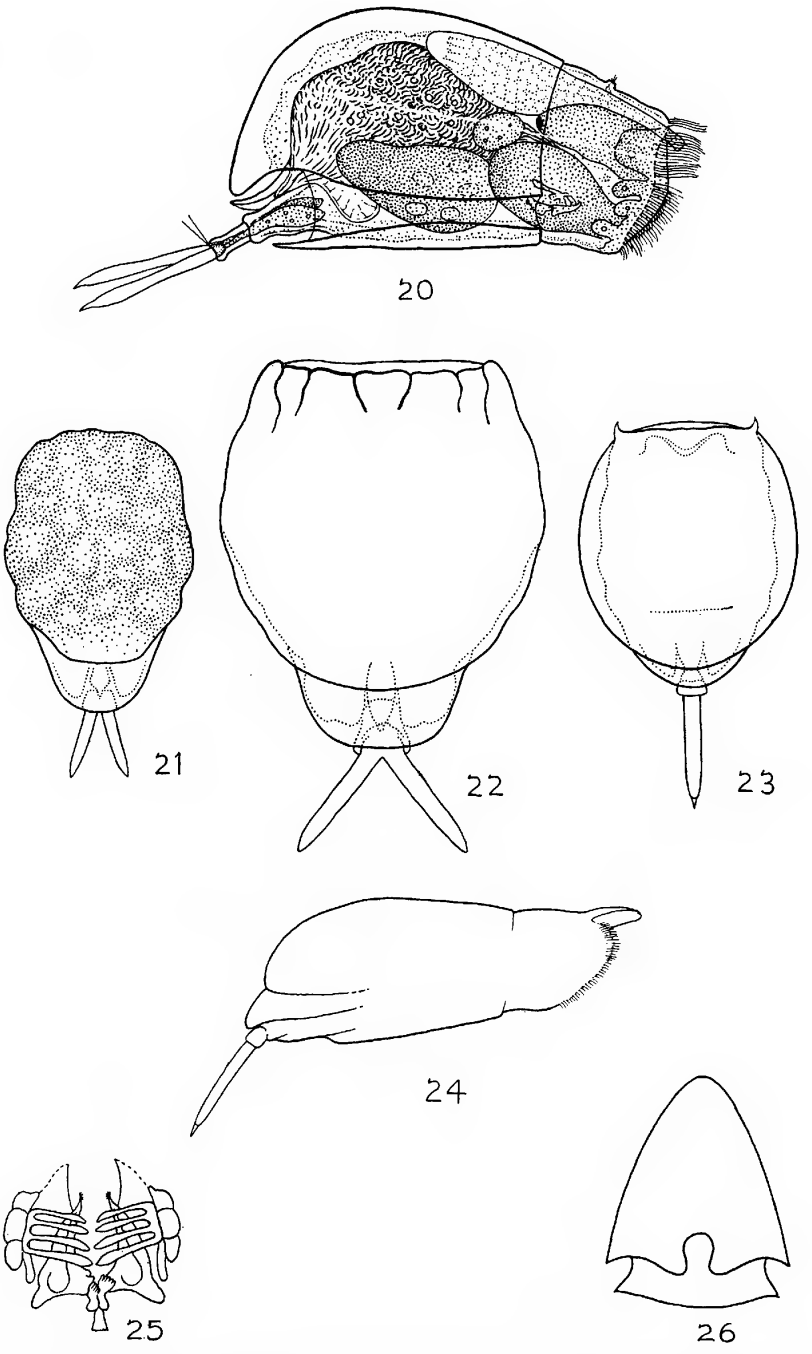

Fig. 20. *Euchlanis arenosa*, lateral view. Fig. 21. *Lecane tenua*, dorsal view. Fig. 22. *Lecane inquieta*, dorsal view. Fig. 23. *Monostyla mitella*, dorsal view. Fig. 24. *Monostyla mitella*, expanded specimen, lateral view. Fig. 25. *Euchlanis arenosa*, trophi, ventral oblique view. Fig. 26. *Euchlanis arenosa*, lorica, cross-section.

somewhat analogous to the posterior segment in the closely related genera *Lecane* and *Monostyla*.

Cat. No. A. M. N. Hist. 754, paratype.

Family **Brachionidae**

Subfamily **Lecaninae**

Lecane inquieta, new species[1]

Figure 22

The outline of the lorica is broadly ovate. The integument is quite flexible and the anterior margins somewhat variable. The dorsal plate is subcircular and rounded posteriorly. The ventral plate is of the same width as the dorsal for half its length, the posterior half being narrower. The lateral sulci are indistinct. The posterior segment is broad and truncate distally; it projects far beyond the dorsal plate. The coxal plates are large and distinct; they are subsquare and have a characteristic notch in the middle of the posterior edge. The first foot joint is slender and fusiform, the second large and broadly pyriform. The toes are fairly long and stout, parallel sided and slightly undulate, ending in abrupt blunt tips.

Length of dorsal plate, 96μ; ventral plate, 101μ; toes, 35μ. Width of lorica, 90μ.

Lecane inquieta was found abundantly in the hygropsammon of Lenape and Union Lakes, during the spring and summer months. Its movements, unlike most of the other species of the genus, are extremely fast and restless, giving an impression of being a forcipate notommatid. It seldom contracts in life, and must be treated with a solution of formalin in order to bring about that state, so it may be studied while fully contracted. It is a psammobiotic species.

Cat. No. A. M. N. Hist. 755, cotype.

Lecane tenua, new species

Figure 21

This species, although smaller than the preceding, bears a superficial resemblance to it. The body is much more elongate, and the dorsal and ventral plates are equal in width throughout. The posterior segment is not so squarish, but more rounded and projects much farther beyond the dorsal plate. The coxal plates are prominent, bluntly pointed and not subsquare, as in the preceding species. The toes are relatively short, parallel sided and end in obtuse tips.

Length of dorsal plate, 70μ; ventral plate, 85μ; toes, 25μ. Width of lorica, 60μ.

Lecane tenua was found in the hygropsammon of Lenape and Union Lakes, during the spring and summer months. It was also found in smaller bodies of water, such as Pleasant Mills and Great Harbor

[1] In order to avoid duplication, the dotted lines in the figures of the genera *Lecane* and *Monostyla* should be considered as referring to details below the dorsal plate.

River at Weymouth. It is a psammobiotic species.

Cat. No. A. M. N. Hist. 750, cotype.

Family **Brachionidae**

Subfamily **Lecaninae**

Monostyla mitella, new species

Figures 23, 24

The outline of the lorica is broadly oval. The anterior margin of the dorsal plate is somewhat convex, while that of the ventral is straight. At the anterior, external angles are two acute frontal spines. The dorsal plate is oval and rounded posteriorly. The ventral plate is considerably narrower than the dorsal; it is somewhat flexible, and its margins undulate. The lorica is without any surface markings. The posterior segment is small and round. The coxal plates are moderately large and obtusely pointed. The first foot joint is poorly defined, while the second is fairly large and heart-shaped, projecting slightly beyond the lorica. The toe is quite long and the edges are parallel-sided. The claw is minute and without basal spicules; it continues the outline of the toe which is slightly constricted posteriorly.

The corona is protected dorsally by a distinct head hood, as in the related genus *Lepadella.*

Length of dorsal plate, 76μ; ventral plate, 80μ; toes, 35μ. Width of anterior points, 40μ; dorsal plate, 65μ; ventral plate, 55μ.

Monostyla mitella was common in the hygropsammon of Lenape and Union Lakes, Great Harbor River at Weymouth, and Pleasant Mills, during the spring and summer. This species, together with *Monostyla galeata* Bryce, are the only members of the genus possessing a head hood. It differs from *Monostyla galeata* by the presence of lateral anterior spines, by the slightly convex dorsal margin, by the claw without basal spicules and by the posterior segment, which is round and rather small, while in the Bryce species it is very prominent, truncate posteriorly and projects far beyond the dorsal plate. *Monostyla galeata* is a rotifer of the *Sphagnum* fauna, while *Monostyla mitella* is a psammobiotic species.

Cat. No. A. M. N. Hist. 752, 754, paratypes.

There are 82 species of psammolittoral rotifers recorded from Poland, while herein are recorded 146 species from southern New Jersey. This is not surprising in view of the fact, as pointed out by Harring and Myers, that alkaline water associations contain countless individuals but relatively few species, while acid water associations contain relatively few individuals divided among many species. In the spring of 1924, eighty-four species of rotifers were recorded during one day's collecting among submerged and floating *Sphagnum* and *Utricularia,* along the shores of Lenape Lake. During three months, collections were made

almost daily in the alkaline waters of southern California, and only 106 species were found.

When a species is found only in the hygropsammon or the eupsammon and nowhere else, not even in collections from the littoral region taken over a period of time, it is safe to assume it is psammobiotic.

Some rotifers get into the moist sand of the hygropsammon because the eggs of duration are washed up by the waves, or left there by changes in the water level, afterward hatching out. Others are also washed there directly by wave action. These are generally psammoxene species; they find conditions of existence unbearable and soon perish. Many rotifers, getting into the sand by the above means, find conditions of existence favorable; they thrive in the environment as well as in the littoral region among aquatic vegetation of the body of water itself. These are psammophile rotifers. Some rotifers exist only in the hygropsammon or the eupsammon or both, which is their natural habitat. They are found nowhere else, except fortuitously and are psammobiotic species.

On account of their small size, most rotifers are not specially adapted to a psammolittoral existence. The adaptation to the environment in some of them, however, is manifest in various ways, including a life in the thin layer of water between the grains of sand, resulting in great dorsoventral or lateral compression, as *Euchlanis arenosa*, *Wigrella depressa*, *Wierzejskiella sabulosa* and *Cephalodella remanei*. Many have the power of adhering firmly, resulting in strongly developed foot glands, as *Euchlanis arenosa*, *Aspelta egregium* and *Encentrum insolitum*. While there are no special adaptations for swiftness of movement, a number of psammobiotic species are notable for the rapidity in which they move about, such as *Euchlanis arenosa*, *Trichotria eukosmeta*, *Diurella insolens* and *Lecane inquieta*.

The number of psammophile species found in the hygropsammon is influenced by the proximity of marginal aquatic vegetation, especially *Sphagnum*, *Utricularia* and other plants with finely dissected leaves. If there is little marginal vegetation the number of such species will be relatively few, while the number of psammobiotic species will remain approximately constant.

In comparing the psammolittoral rotifers of Poland with those of southern New Jersey, it is evident the fauna of alkaline bodies of water differs markedly from similar acid water associations. The result of investigating the psammolittoral clearly shows the presence of a distinct rotatorian fauna hitherto unsuspected, and rich in species adapted to a life in the water contained between the grains of sand.

NOTES ON SPECIES

Trichotria eukosmeta Myers

Trichotria eukosmeta Myers, 1934, American Museum Novitates, No. 761, p. 6, Figs. 13, 14.

A few specimens of this species were collected in algae growing on sand in very shallow water, near the southern margin of Faun Pond, Mount Desert Island, Maine, during the summer of 1926. Not enough material was found at that time to make a thorough study of its habits.

During the months of August and September of 1934, this species was found in abundance in the hygropsammon of both Lenape and Union Lakes. There is no doubt, therefore, about its being a psammobiotic species. Its occurrence in the algae of Faun Pond was merely fortuitous.

Lecane mucronata Harring and Myers

Lecane mucronata Harring and Myers, 1926, Trans. Wis. Acad. Sci. Arts Lett., XXVI, p. 330, Pl. xxix, figs. 3, 4.

During the month of September this species was found in superabundance in the hygropsammon of Union Lake. It was previously considered to be rare although widely distributed. It resembles *Lecane inquieta* in movement, being rapid and seldom contracting. It was found at Batsto, New Jersey, in 1924 among algae growing on sand in shallow water; the same kind of environment in which *Trichotria eukosmeta* was originally found. In view of the above facts, it is without doubt a psammobiotic species.

Lepadella triptera var. **alata** Myers

Lepadella triptera var. *alata* Myers, 1934, American Museum Novitates, No. 760, p. 10, Figs. 29–32.

In a recent communication from J. Hauer, Karlsruhe, Germany, he called my attention to the fact that he found this variation in collections from Fundort, Sumatra, and not from near Karlsruhe, as stated in the Novitates.

Colurella aemula Myers

Colurella aemula Myers, 1934, American Museum Novitates, No. 700, p. 16, Fig. 13.

This species has been found by Hauer in a collection from near Toba-Heide, Sumatra. He observed that it has a longitudinal dorsal cleft of the lorica. I have confirmed this, and also found the cleft to

be present in the closely related species *Colurella logima*. This precludes their retention in the genus *Colurella*, in which the dorsum is always confluent with the lateral plates, and never cleft. I propose, therefore, the generic name of *Paracolurella*.

PARACOLURELLA, NEW GENUS

Body loricated, oval or ovate, laterally compressed; lorica of two lateral plates, open anteriorly and posteriorly, longitudinally cleft dorsally and open ventrally; frontal head hood present; foot of three joints, the terminal being as long or longer than the combined length of the basal and second joints; foot terminated by two toes; mastax malleate.

Paracolurella is an intermediate genus, partaking of the characters of both *Colurella* and *Mytilina*.